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TECHNICAL RESOURCE DOCUMENTS AND TECHNICAL HANDBOOKS FOR HAZARDOUS WASTES MANAGEMENT

by

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16. ABSTRACT

The Environmental Protection Agency is preparing a series of Technical Resource Documents (TRD's) and Technical Handbooks to provide best engineering control technology to meet the needs of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) respectively. These documents and handbooks are basically compilation of research efforts of the Land Pollution Control Division (LPCD) to date. The specific areas of research being conducted under the RCRA land disposal program relate to laboratory, pilot and field validation studies in cover systems, waste leaching and solidification, liner systems and disposal facility evaluation. The specific areas of research being conducted under the CERCLA uncontrolled waste sites (Superfund) program relate to pilot and field validation studies in barriers, waste storage, waste treatment, modeling and post-closure evaluation. The technical resource documents are intended to assist both the regulated community and the permitting authorities, as well as support the RCRA Technical Guidance Documents prepared by EPA's Office of Solid Waste (OSW). The technical handbooks provide the EPA Program Offices and Regions, as well as the states and other interested parties, with the latest information relevant to remedial actions.

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ABSTRACT

The U.S. EPA's Office of Research and Development (ORD) is preparing a series of Technical Resource Documents (TRD's) and Technical Handbooks to provide best engineering control technology to meet the needs of the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) respectively. These documents and handbooks are basically compilations of research efforts of ORD's Land Pollution Control Division (LPCD) to date. The specific areas of research being conducted under the RCRA land disposal program relate to laboratory, pilot and field validation studies in cover systems, waste leaching and solidification, liner systems and disposal facility evaluation. The specific areas of research being conducted under the CERCLA uncontrolled waste sites (Superfund) program relate to pilot and field validation studies in barriers, waste storage, waste treatment, modeling and post-closure evaluation. The Technical Resource Documents are intended to assist both the regulated community and the permitting authorities for development of new hazardous waste disposal facilities. The Technical Handbooks provide the EPA Program Offices and Regions, as well as the states and other interested parties, with the latest information relevant to remedial actions.

INTRODUCTION

Land disposal of hazardous waste is subject to the requirements of Subtitle C of the Resource Conservation and Recovery Act (RCRA) of 1976 and to the 1984 Amendments to this Act. This Act requires that the treatment, storage, or disposal of hazardous waste be carried out in accordance with RCRA regulations. Owners and operators of new facilities must apply for and receive a RCRA permit before beginning operation of such a facility.

The development of proper control technology for new (RCRA) waste disposal facilities will combine information from laboratory, pilot and field validation studies in the research areas of cover systems, waste leaching and solidification, liner systems and disposal facility evaluation.

° Cover systems research is developing and evaluating the effectiveness of various material components (i.e., vegetation, soils, membranes, and drainage blankets) in relation to the cover function of minimizing moisture ingress and gas egress.

° Waste leaching research is investigating techniques for predicting the composition of actual field leachates from samples of wastes or mixtures of wastes.

° Waste solidification research is evaluating the effectiveness and performance with time of chemical stabilization and encapsulation processes to minimize the release of pollutants to the environment.

° Liner systems research is evaluating the effectiveness and performance of clay and flexible membrane materials (as liners) with time to contain and minimize the release of leachate and gas pollutants to the environment.

° Disposal facility evaluation research is evaluating effective techniques to ensure that land disposal facilities are built as designed for either permanent disposal or short/long-term storage.

Incorporated throughout the research for development of control technology for new waste disposal facilities is a continuous technology transfer and assistance program of activity for the program office and regional offices and user communities. The TRD's are considered to be primary documents for transferring current RCRA control technologies to the user. The TRD's are being developed and published to assist the permit applicants and permit review officials to assure that the latest containment facility technology is being utilized. The TRD's are to be used in conjunction with the Technical Guidance Documents being prepared by OSW. These documents contain guidance, not regulations or requirements which the Agency believes comply with Design and Operating Requirements and the Closure and Post-Closure Requirements contained in Part 264 of the regulations. The information and guidance presented in these documents constitute a suggested approach for and evaluation based on good engineering practices. There may be alternative and equivalent methods for conducting the review and evaluation. However, if the results of these methods differ from those of the Environmental Protection Agency's method, they may have to be validated by the applicant.

The clean up/containment technology associated with remedial action at an existing uncontrolled hazardous waste site is subject to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund). This Act requires evaluation of remedial action clean up technologies.

The development of proper containment technology to upgrade existing (CERCLA) waste disposal facilities will combine information from the above described program for new waste disposal facilities along with pilot and field validation studies in the research areas of barriers, waste storage, waste treatment, modeling, and post-closure evaluation.

° Barrier research is developing and evaluating in-situ control technologies to contain or minimize pollutant releases from uncontrolled sites and to predict performance with time. In-situ control technologies such as slurry walls, grout curtain cut-off walls, and covers are being evaluated.

° Waste storage research is evaluating

the cost-effectiveness of placing wastes from the clean up of uncontrolled sites into mines or aboveground storage facilities. Also, packaging of hazardous wastes in various containers is being investigated.

° Waste treatment research is evaluating the effectiveness of various techniques for treating the wastes or collected leachates in-place or on site. Techniques such as stabilization, encapsulation, permeable treatment walls, microbial degradation, and physical/chemical treatment are being investigated.

° Modeling technology has been developed for evaluation of remedial action alternatives and will be updated to reflect improved performance, reliability, and cost information from field scale studies, case studies and other research areas.

° Post-closure research is evaluating the criteria for final site usage once the disposal facility has been remediated.

Incorporated throughout the research for development of containment technology for existing waste disposal facilities is a continuous technology transfer and assistance program of activity for the program office and user communities. The Technical Handbooks are considered to be the primary documents for transferring current CERCLA containment technology to the user.

To meet the control technology aspects of RCRA and CERCLA as relates to land disposal facilities, the research program has relied heavily on the containment aspects of the wastes at the facility or site. The containment aspects for waste disposal onto the land need to address the development of performance and operational standards for new waste disposal facilities (RCRA sites) and the containment or destruction of pollutants emanating from existing waste disposal facilities (CERCLA sites). The control technology research approach being pursued by the USEPA is to develop an improved data base so that current waste disposal practices can be upgraded by developing proper site selection criteria and control technology for the establishment of new waste disposal facilities, and to develop improved containment technology for existing waste disposal sites by minimizing pollutant generation and release to the environment.

TECHNICAL RESOURCE DOCUMENTS

Nine TRD's have been completed to date. Seven of the TRD's are related to landfills, and one document each is related to surface impoundments and land treatment. A listing of these documents if shown below, along with a brief description, publication number, and the project officer's name in parentheses.

Evaluating Cover Systems for Solid and Hazardous Waste (SW-867)

A critical part of the sequence of designing, construction, and maintaining an effective cover over solid and hazardous waste sites is the evaluation of engineering plans. This TRD presents a procedure for evaluating closure covers on solid and hazardous wastes sites. All aspects of covers are addressed in detail to allow for a complete evaluation of the entire cover system. There are eleven sequential procedures identified for evaluating engineering plans.

The document describes current technology for landfill covers in three broad areas: data examination,

evaluation steps and post-closure plan. The data examination discusses test data review procedures, topographical data review and climatological data review procedures, topographical data review and climatological data review procedures. The evaluation steps include cover composition, thickness, placement, configuration, drainage and vegetation. The post-closure aspects include maintenance and contingency plan evaluation procedures. There are 36 specific steps, regarding the preceding factors, which are recommended to be followed in evaluating a permit for a cover for hazardous waste.
*055-000-0228-2 (R. E. Landreth).

Hydrologic Simulation on Solid Waste Disposal Sites (SW-868)

This TRD provides a computer package to aid planners and designers by simulating hydrologic characteristics of landfill covers to predict percolation as a function of cover design and climate. It has been updated to include the two-dimensional aspects of landfill cover systems. This updated version is entitled "Hydrologic Evaluation of Landfill Performance (HELP) Model". The HELP model TRD will replace the SW-868 TRD. (D. C. Ammon).

Hydrologic Evaluation of Landfill Performance (HELP) Model: Vol. I (SW-84-009) and Vol. II (SW-84-010)

The HELP Model is a modification of the original waste disposal site hydrologic model entitled, "Hydrologic Simulation on Solid Waste Disposal Sites." This update has incorporated the two-dimensional aspects of landfill cover systems, as well as the addition of the leachate collection system. This TRD was published for public comment in two volumes (+PB 85-100-840 and PB 85-100-832, respectively). The two volumes include the user's guide for version 1 and documentation and description of the program. Version 2 of the HELP Model is being developed to incorporate public comment and results from verification studies and will be published in late 1986. (D. C. Ammon)

Landfill and Surface Impoundment Performance Evaluation (SW-869)

The evaluation of leachate collection systems using compacted clay of synthetic liners to determine how much leachate will be collected and how much will seep through the liner into underlying soils is presented. The adequacy of sand and gravel drain layers, slope, and pipe spacing is also covered. The author has allowed for the widely varied technical backgrounds of his intended audience by presenting, in full, the rigorous mathematics involved in reaching his final equations. Thus, any evaluator can take full advantage of the TRD up to the level of his own mathematical proficiency.
*055-000-00233-9 (M. H. Roulier).

* These TRD's have been published and are available from GPA by requesting the stock number. Copies may be purchased from:
  Superintendent of Documents
  U. S. Government Printing Office
  Washington, DC 20402
  Phone: (202) 782-3238

+ These documents have been published and the reports are available from NTIS by requesting the stock number. Copies can be purchased from:
  National Technical Information Service
  5285 Port Royal Road
  Springfield, VA 22161
  Telephone: (703) 487-4650

Lining of Waste Impoundment and Disposal Facilities (SW-870)

This TRD provides information on performance, selection, and installation of specific liners and cover materials for specific disposal situations, based upon the current state-of-the-art of liner technology and other pertinent technologies. It contains descriptions of wastes and their effects on linings, a full description of various natural and artificial liners, service life and failure mechanisms, installation problems and requirements of liner types, costs of liners and installation, and tests that are necessary for pre-installation and monitoring surveys. A revised version should be available in late 1986.
*055-000-00231-2 (R. E. Landreth)

Management of Hazardous Waste Leachate (SW-871)

This TRD has been prepared to provide guidance for permit officials and disposal site operators on available management options for controlling, treating, and disposing of hazardous waste leachates. It discusses considerations necessary to develop sound management plans for leachate generated at surface impoundments and landfills. Management may take the form of leachate collection and treatment, or pretreatment of the wastes.
*055-000-00224-0 (S. C. James)

Guide to the Disposal of Chemically Stabilized and Solidified Wastes (SW-872)

The purpose of this TRD is to provide guidance in the use of chemical stabilization/solidification techniques for limiting hazards posed by toxic wastes in the environment, and to assist in the evaluation of permit applications related to this disposal technology. The TRD addresses the treatment of hazardous waste for disposal or long term storage and surveys the current state and effectiveness of waste treatment technology. A summary of the major physical and chemical properties of treated wastes is presented. A listing of major suppliers of stabilization/solidification technology and a summary of each process is included.
*055-000-00226-6 (R. E. Landreth)

Closure of Hazardous Waste Surface Impoundments (SW-873)

The methods, tests, and procedures involved in closing a surface impoundment are discussed and referenced. Problems related to abandoned impoundments causing environmental degradation are discussed. Closure methods such as waste removal, consolidating the waste on site and securing the site as a landfill are also discussed. It is written primarily for staff members in EPA regional offices or state regulatory offices, who are charged with evaluating and approving closure plans for surface impoundments under regulations of the Resource Conservation and Recovery Act of 1976. Methods of assessing site closure considerations are documented.
*055-000-00227-4 (M. H. Roulier)

Hazardous Waste Land Treatment (SW-874)

The objectives of "Hazardous Waste Land Treatment" are to describe current technology and to provide methods for evaluating the performance of an applicant's hazardous waste land treatment facility design. Land treatment is approached comprehensively from initial site selection through final closure, and additional information sources are referenced liberally. Land treatment, which involves using the surface soil as the treatment medium, is already widely practiced by some industries for handling their hazardous wastes.
*055-000-00232-1 (C. C. Wiles)

FUTURE TECHNICAL RESOURCE DOCUMENTS

Additional TRD's now being developed or in planning stages by the Office of Research and Development are shown below, along with a brief description and the project officer's name in parentheses.

Soil Properties, Classification and Hydraulic Conductivity Testing

This TRD is a compilation of available laboratory and field testing methods for the measurement of hydraulic conductivity (permeability) of soils. Background information on soil classification, soil water, and soil compaction are included along with descriptions of sixteen methods for determination of saturated or unsaturated hydraulic conductivity. This TRD (SW-925) was published in March 1984 for public comment. It is being revised to incorporate public comments that were received. The revised version will be published through the Government Printing Office in late 1986. (M. H. Roulier)

Solid Waste Leaching Procedures Manual

This is a TRD on laboratory batch procedures for extracting or leaching a sample of solid waste so that the composition of the lab leachate is similar to the composition of leachate from waste under field conditions. This TRD (SW-924) was published in March, 1984 for public comment. It is being revised to incorporate public comments that were received. The revised version will be available through the Government Printing Office in late 1986. (M. H. Roulier)

This project is studying the feasibility of using soil/leachate batch adsorption procedures for designing compacted clay liners to remove/retain known amounts of pollutants, and will contribute to information on designing and evaluating clay liners to limit pollutant release from landfills. The project will be completed in late 1986. (M. H. Roulier)

Methods for the Prediction of Leachate Plume Migration and Mixing

This project has developed a variety of computer programs for hand-held calculators, microcomputers, and macrocomputers. The programs predict leachate plume migration from single and multiple sources. The document also contains discussions of sorption, case histories and a field study. A draft for public comment will be completed in early 1987. (M. H. Roulier)

Design, Construction, Maintenance, and Evaluation of Clay Liners for Hazardous Waste Facilities

This TRD has gathered and assembled information on construction and use of compacted soil liners, including test methods, chemical compatibility, failure mechanisms, performance of existing facilities, and field quality assurance and inspection to insure that the liner performs as designed. The project is scheduled for completion in summer 1986. (M. H. Roulier)

TECHNICAL HANDBOOKS

Nine technical handbooks have been completed to date. These handbooks cover a variety of techniques from general remedial action guidance; to in-situ treatment; to barriers; to decontamination and modeling. A listing of these handbooks is shown below, along with a brief description, publication number, and the project officer's name in parenthesis.

Guidance Manual for Minimizing Pollution from Waste Disposal Sites (EPA 600/2-78-142)

This Handbook provides guidance in the selection on available engineering technology to reduce or eliminate leachate generation at existing dumps and landfills. Most of the techniques discussed in the report deal with the reduction or elimination of infiltration into landfills in one of five categories, active groundwater or plume management, chemical immobilization of wastes, and excavation and reburial. The manual emphasizes passive remedial measueres, requiring little or no maintenance once emplaced. Other measures are active and require a continuing input of manpower or electricity.
+PB 286 905/AS (D. E. Sanning)

Review of In-Place Treatment Techniques for Contaminated Surface Soils Vol. I (EPA 540/2-84-003a) and Vol. II (EPA 540/2-84-003b)

This two-volume Handbook presents information on in-place treatment technologies applicable to contaminated soils less than 2 feet in depth. Volume I discusses the selection of the appropriate in-place treatment technology for a particular site and provides specific information on each technology. Volume 2 provides background information and relevant chemical data.

Selection of in-place treatment technologies follows the process outlined in the National Contingency Plan. The type of in-place treatment (extraction, immobilization, degradation, attenuation, or reduction of volatiles) is determined on the basis of information available from the remedial investigation. Selection of a specific technology involves assessment of waste, soil, and site-specific variables. The technology is implemented if it is considered more cost-effective in comparison with the other alternatives.
+PB 85-124881 Vol. 1 (N. P. Barkley)
+PB 85-124889 Vol. 2 (N. P. Barkley)

Remedial Action at Waste Disposal Sites (revised) (EPA 625/6-85-006)

This handbook is intended for use as a basic reference tool on remedial action. It will assist government and industrial officials and technical persons with the range of remedial technologies; their applications and limitations; major design and construction considerations; technology selection/evaluation; operation, maintenance and monitoring; and approximate costs. It provides sufficient information on remedial technologies to enable the user to select potentially applicable technologies for a given site, and understand what is involved in designing and implementing these technologies. While emphasis is placed on those technologies which have been demonstrated for hazardous waste sites, information is also included on emerging technologies. No order number is yet available. (D. E. Sanning)

Handbook for Evaluating Remedial Action Technology Plans (EPA 600/2-83-076)

This Remedial Action Handbook describes how the technologies and methods for evaluating proposed new RCRA hazardous waste disposal sites can be applied to site-specific remedial response activities for uncontrolled hazardous waste sites. The Remedial Action Handbook is based on the state-of-the-art technical and cost information in eight TRDs for design and evaluation of new hazardous waste disposal sites under RCRA. That information will be reviewed for relevance to remedial response at uncontrolled hazardous waste disposal sites, and will be edited and refocused to address the needs of personnel involved in response and remedial action planning under CERCLA.
+PB 84-1182149 (H. R. Pahren)

Slurry Trench Construction for Pollution Migration Control (EPA 540/2-84-001)

A Handbook for slurry trench cut-off wall design, construction, and performance evaluation provides recommendations on a variety of scientific and technical parameters relevant to using this approach to isolate hazardous chemicals in near-surface groundwater regimes. The accomplishment of this effort required extensive information gathering and integration of technical data gathered from a diverse array of experience and authorities. +PB 84-177831 (W. E. Grube)

Guide for Decontaminating Buildings, Structures and Equipment at Superfund Sites (EPA 600/2-85-028)

A decontamination Handbook was designed for EPA Headquarters program offices and regional Superfund programs as part of the restoration profile of Superfund sites. The manual gives guidelines on: 1) the extent to which contamination of buildings, structures and construction equipment can be reduced or eliminated, 2) decontamination methods, 3) economics, 4) health hazards and 5) availability of equipment/personnel for the detoxification procedures. Specific waste types found in contaminated buildings, structures and equipment at Superfund sites are identified. Potential secondary impacts from the available and potential decontamination treatment methods are addressed in this study. Costs versus risk and projected ultimate site usage are also addressed. Methods for monitoring the success of the various procedures are defined. +PB 85-201234 (N. P. Barkley)

Modeling Remedial Actions at Uncontrolled Hazardous Waste Sites (EPA 540/2-85-001)

The objective of this Handbook is to provide technical guidance on the selection and application of models for evaluating remedial action alternatives at uncontrolled hazardous waste sites. The volumes cover selection of models, simplified methods for subsurface and waste control actions, and analytical and numerical models for evaluation of surface water remedial actions. +PB 85-211357 (D. C. Ammon)

Leachate Plume Management (EPA540/2-85-004)

A Study on leachate plume management techniques has been conducted. This handbook describes the factors that affect leachate plume movement, key considerations in delineating the current and future extent of the leachate plume technologies for contolling the migration of plumes, and criteria for evaluating and selecting plume management alternatives. +PB 122330 (N. P. Barkley).

Dust Control at Hazardous Waste Sites (EPA 540/2-85-003)

Three field studies were performed to determine the effectiveness of dust control technologies at hazardous sites. In the first field study, dust suppressants were tested to determine the effectiveness of fugitive dust control against wind erosion from exposed areas. The second field study was an evaluation of the effectiveness of windscreens and windscreen/dust suppressant combinations in controlling fugitive dust from storage piles. The third field study, investigating active cleanup emissions, consisted of testing fugitive dust control measures applicable to the use of a front-end loader to load dirt into a truck. No order number is yet available. (S. C. James)

FUTURE TECHNICAL HANDBOOKS

Additional technical handbooks are now being developed or are in planning stages by the Office of Research and Development. A listing of these handbooks is shown below, along with a brief description and the project officer's name in parenthesis.

Evaluation of Systems to Accelerate the Stabilization of Waste Piles of Deposits

This Handbook investigates in situ systems which accelerate the stabilization of waste deposits. In situ applications involve three essential elements: selection of a chemical or biological agent (reactant) which can react with and stabilize the waste, a method for delivery of the reactant to the deposit and a method for recovery of the reaction products or mobilized waste.

Four reactant categories have been examined; biodegradation, surfactant-assistant flushing, hydrolysis, and oxidation. Methods of delivery of reactants based upon gravity include surface flooding, ponding, surface spraying, ditching, and infiltration beds and galleries. Forced injection (pumping) may also be used. Recovery systems using gravity include open ditching and buried drains, and pumped methods include wellpoint and well systems. This Handbook will be available in the fall of 1986.
(W. E. Grube)

Covers for Uncontrolled Hazardous Waste Sites

A handbook is being developed which can be used as a guidance document for the selection, design, installation, and long-term maintenance of covers as remedial actions. This handbook will provide technical information for regulatory personnel as well as guidance for cover-system designers and construction engineers, and will be available in late 1986.
(J. M. Houthoofd)

Stabilization/Solidification Alternatives for Remedial Action at Uncontrolled Waste Sites

Another handbook is being developed to provide guidance for the evaluation, selection, and use of solidification/stabilization technology as a remedial action alternative at uncontrolled hazardous waste sites. The planning for application of solidification/stabilization is divided into two phases: process selection and scenario selection. Process selection is concerned with the chemistry of the Stabilization/solidification processes in the identification of the composition of the waste. Presented in the handbook are testing and analysis techniques for characterizing waste as a basis for selection of pretreatment and stabilization/solidification processes. Also data are being developed on the compatibility of additives and specific classes of waste, and testing systems for the evaluation of stabilized/solidified wastes are being reviewed. Scenario selection is concerned with the development of equipment requirements, construction sequencing, and cost estimating for the chosen solidification/stabilization process. The handbook will present, based on field surveys, four basic field scenarios that have been used successfully, and will be published in the fall of 1986.
(J. M. Houthoofd)

CONCLUSION

The Technical Resource Documents and the Technical Handbooks that are being prepared and updated by the ORD's

Land Pollution Control Division (LPCD) are a series of documents which provide best engineering control technology to meet the needs of RCRA and CERCLA, respectively. The TRD's provide design operation, and evaluation information related to new RCRA hazardous waste disposal facilities to assist the regulated community and the permitting authorities. The Technical Handbooks provide reliable and cost effective remedial action technology information related to Superfund facilities to assist the user community and on-scene coordinators. These documents and handbooks present the sum total of the body of information and experience gained by the Agency over the years on a given topic. As new information is developed, the Agency intends to update each of these TRD's and Technical Handbooks so that they reflect the latest state-of-the art information.

More information about a specific project or study can be obtained by contacting the Project Officer referenced in the text.

The Project Officers can be contacted by writing or telephoning the USEPA, Hazardous Waste Engineering Research Laboratory, Land Pollution Control Division, 26 west St. Clair Street, Cincinnati, Ohio 45268 Telephone (513) 569-7871.